

**SECTION 57****LUBE OIL STORAGE, FILL AND TRANSFER SYSTEM**

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## 57.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for the lubricating oil systems needed to operate the diesel engines, Reduction Gears, CPP propellers, Steering Gears, and miscellaneous machinery. It addresses issues relevant to the on-load, storage, purification, and transfer of both clean and used oils. All oil and grease used by the Contractor will be the type, brand, and grade as specified by the equipment manufacturer and currently supplied to WSF under the existing WSF supplier contracts.

*For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.*

## 57.3 GENERAL

It is intended that the number of different oils used on the Vessel be kept to a minimum. To this end, the design shall promote commonality of oils for as many services as possible. In all cases, oil products shall be supportable using the current WSF lubricant contract shall be used as required by the *GENERAL* Subsection in Section 50 of the Technical Specification.

These requirements assume that each type of equipment (Main Engines, Ship's Service & Emergency Diesel Generators engines, Reduction Gears, etc.) will utilize an oil product that is different from that of other equipment and that, therefore, separate storage tanks, transfer pumps and piping systems will be necessary. If selected equipment is found to accept the same type of oil, the Contractor may modify the requirements of this Section of the Technical Specification, subject to review and approval of the WSF Representative, to provide a common storage tank, transfer pump and integrated piping system to the extent practicable for the equipment.

On-board systems' design pressures and pipe sizes shall be coordinated to suit the requirements of this Section and the flow velocity restrictions of Section 74 of the Technical Specification.

Each Main Engine, SSDG & the Emergency Diesel Generator engine lube oil system, Stern Tube, Reduction Gear, and **all** hydraulic oil systems shall include a dedicated ½ inch globe valved sample connection with lock-close feature (see Section 74 of the Technical Specification), cap/chain and drip pan.

Built-in containment coamings shall be provided for all oil equipment foundations. Drip pans shall be permanently installed beneath such items as strainers and filters.

See Section 74 of the Technical Specification for general piping and material requirements and Section 75 of the Technical Specification for insulation and lagging requirements. See Section 78 of the Technical Specification for general tank requirements.

The Contractor shall interface with the PSI Contractor and the SSDG Contractor to determine those oils required for all equipment and provide proper storage and transfer meeting the requirements of this Section.

## **57.4 TANKS**

### **57.4.1 Clean Hydraulic Oil Storage Tanks**

Tanks shall be provided for storage of hydraulic oil for the Controllable Pitch Propeller (CPP) propeller, Steering Gear, and all other hydraulic power units in accordance with this Section and Sections 78 and 81 of the Technical Specification. The hydraulic oil storage tanks shall be located near the machinery served and appropriately sized as set forth in Sections 78 and 81 of the Technical Specification. The intent and requirement for the CPP system tanks shall be a design by the PSI Contractor, and the Contractor shall provide material, fabrication, and installation of those tanks.

Hydraulic oil storage tanks, except those serving the Steering Gears, shall be filled remotely from the Lower Vehicle Deck fueling station via permanently installed piping systems. The hydraulic oil tanks shall be independent and sized appropriate to the quantity stored and location of the equipment. Structural tanks may not have a common boundary with shell plating.

Unless otherwise noted, the location of the hydraulic oil storage tanks, except the Steering Gear storage tank, shall permit each hydraulic unit's integral oil reservoir to be gravity filled via permanently installed piping.

The fixed storage tank for each Steering Gear shall be installed at the same level or below the system oil reservoir and supply hydraulic oil to the system reservoir/head tank via a hand operated pump. The fill pipe for each fixed storage tank shall be sized, as set forth by the Contractor's tank design, and routed from the tank inlet over to an accessible location just inside the Steering Gear Room access hatch opening, as approved by the WSF Representative, and terminate with a capped cam-lock fitting. The CPP storage and reservoir/head tanks shall be fabricated from Type 304L stainless steel materials in accordance with the PSI Contractor's design.

With the exception of tanks designed by the PSI Contractor, each storage tank of less than 100 U.S. gallons shall be equipped with a minimum 1/2 inch full-port ball valve drain connection with cap and chain for draining water and sediment. Storage tanks over 100 gallons shall be equipped with a 1 1/2 inch ball valve drain connection with cap and chain for draining water and sediment.

Where hydraulic reservoirs must be filled by hand, storage tanks shall be equipped with a portable container fill station consisting of a 3/4 inch full-port ball valve fill connection

with container stand and drip pan. The valve shall have a lock-close feature (see Section 74 of the Technical Specification), and the fill spout shall have cap and chain.

#### **57.4.2 Clean Lube Oil Storage Tanks**

The Main Engine lube oil storage tanks, one (1) in each Reduction Gear Room, shall be structural tanks, appropriately sized as set forth in Section 78 of the Technical Specification, and shall be provided with GEMS SureSite, or equal, level indicator system located in a readily visible location on the Engine Room side of the bulkhead between the Reduction Gear Room and the Engine Room.

The Ship's Service Diesel Generator lube oil storage tanks, one (1) in each Engine Room, shall be appropriately sized as set forth in Section 78 of the Technical Specification.

The Reduction Gear lube oil storage tanks, one (1) in each Reduction Gear Room, shall be appropriately sized as set forth in Section 78 of the Technical Specification.

Each storage tank shall be equipped with a ½ inch full-port ball valve drain connection with cap and chain for draining water and sediment.

Each storage tank shall be equipped with a portable container fill station consisting of a full-port ball valve fill connection with container stand and drip pan. The valve shall have a "bung type" spout with lock-close feature, and the fill spout shall have cap and chain.

#### **57.5 LUBE OIL FILLING, OVERFLOW AND TRANSFER SYSTEMS**

The Main Engine lubricating oil fill, overflow, and transfer system shall be designed to permit the following fill and transfer operations:

A. Fill the Main Engine clean lubricating oil structural storage tanks remotely from the Lower Vehicle Deck via a permanently installed piping system from the tank and terminating in the fueling station with a capped cam-lock fitting.

B. Transfer clean lubricating oil from the storage tanks to each Main Engine oil sump via a gravity filling system.

The Ship's Service Diesel Generator engine lubricating oil fill and transfer system shall be designed to permit the following fill and transfer operations:

A. Fill the Ship's Service Diesel Generator clean lubricating oil storage tanks remotely from the Main Deck via a permanently installed piping system from the structural tank and terminating in the fueling station with a capped cam-lock fitting.

B. Transfer clean lubricating oil from the storage tanks to the diesel generator's oil sump via a gravity filling system.

The used oil transfer system provided with an air operated diaphragm type, polypropylene center block, Buna-N internal (wetted) parts, long-life Ultra-Flex diaphragms, aluminum housing, WILDEN P-8 Pro-Flo, or equal, shall be designed to permit the following fill and transfer operations:

- A. Transfer used oil from used oil or oily bilge tanks to a Lower Vehicle Deck discharge capped cam-lock connection in the fueling station.
- B. Transfer used oil from Main Engine, Ship's Service Diesel Generator, and Reduction Gear lube oil sumps to the used oil storage or oily bilge tanks.
- C. Transfer used oil or oily bilge from any used oil or oily bilge holding tank to any other used oil or oily bilge holding tank.
- D. Transfer oil from the CPP Storage tank, CPP Drain tank, or CPP Reservoir to any used oil tank, oily bilge tank, or Lower Vehicle Deck discharge station.
- E. Transfer oil from the Stern Tube Drain tank to any used oil tank, oily bilge tank, or Lower Vehicle Deck discharge station.
- F. Transfer oil from the Stern Tube Drain tank to any used oil tank, oily bilge tank, or Lower Vehicle Deck discharge station.
- G. See Section 70 of the Technical Specification for additional transfer requirements.

A Reduction Gear lubricating oil fill and transfer system shall be provided that permits the following fill and transfer operations:

- A. Fill the Reduction Gear clean lube oil storage tanks remotely from the Lower Vehicle Deck via a permanently installed piping system from the tank and terminating in the fueling station with a capped cam-lock fitting.
- B. Transfer clean lubricating oil from the storage tanks to the Reduction Gears' oil sumps via a permanently installed piping system and a gravity filling system.

A Controllable Pitch Propeller (CPP) hydraulic oil fill and transfer system shall be provided that permits the following fill and transfer operations:

- A. Fill the CPP Storage tank remotely from the Lower Vehicle Deck via a permanently installed piping system from the tank and terminating in the fueling station with a capped kamlock fitting.
- B. Transfer clean hydraulic oil from the CPP Storage tank to the CPP Reservoir or CPP Drain tank via a permanently installed gravity piping system.

All storage tanks, except for steering gear hydraulic oil, shall be filled from the Lower Vehicle Deck fuel oil filling station, using two (2) inch capped cam-lock connections. The

Filling Station shall be accessible to mobile tank trucks from both the tunnel area and the outboard Vehicle Deck area, and arranged for pressurized filling.

The OBERG filter crusher provided in the *ENGINEER'S WORKSHOP AREA AND EQUIPMENT* Subsection in Section 80 of the Technical Specification shall be provided with a 1 inch drain connection, 1 inch full-port ball drain valve, and 1 inch bin drain piping from the waste oil bin at the crusher into the Used Oil Tank in Engine Room No. 1

## **57.6 LUBRICATING OIL SERVICE SYSTEMS**

### **57.6.1 Reduction Gears**

Each Reduction Gear will have its own self-contained lubricating oil system with attached pumps, electric motor driven standby pump, cooler, duplex strainer and filter. The standby pump shall automatically start upon loss of effective lubrication pressure and/or clutch hydraulic oil pressure, and shall not cut out until **both** lubrication oil pressure and clutch oil pressure are restored.

See Reference (57A) regarding the scope of Owner - Furnished Equipment (OFE).

### **57.6.2 Ship's Service Diesel Generator**

Each Ship's Service Diesel Generator will have its own self-contained lubricating oil system with integral sump, circulating pumps, pre-lube pumps, coolers and filters.

See Reference (57A) regarding the scope of Owner - Furnished Equipment (OFE).

### **57.6.3 Main Engines**

Each Main Engine will have its own self-contained lubricating oil system with integral sump, circulating pumps, pre-lube pumps, coolers, and filters.

See Reference (57A) regarding the scope of Owner - Furnished Equipment (OFE).

## **57.7 MOBILE OIL CLEANING SYSTEM**

As part of the Propulsion System Integrator (PSI) Contractor's Contract, an ALFA-LAVAL MIB 303 *EMMIE* Mobile Oil Cleaning System will be provided by the Propulsion System Integrator (PSI) Contractor in accordance with Reference (57A) as OFE (*PSI Contractor furnished*) equipment. This portable purifier will be used to purify oil for the Stern Tube LO, CCP Oil, Reduction Gear LO and Steering Gear LO Systems. In addition, connections shall be provided at the Fuel Oil purifier for emergency purposes.

Working with the PSI Contractor as to required connection design, the Contractor shall provide purifier suction and discharge connections in the abovementioned piping systems for these equipment to allow for attachment of the mobile purifier to the systems piping and tankage. These supply and discharge connections shall have full-port ball valves, appropriate quick-release couplings, and protective caps. Connections shall be sized to suit the mobile purifier connections.

## **57.8 CLEANING AND FLUSHING**

**NOTE:** Lube oil cleaning and flushing procedures shall meet the requirements of all equipment manufacturers. Where a conflict arises between these requirements and the procedures outlined below, the Contractor and WSF shall mutually agree upon deviations from the outlined procedures.

Thoroughly clean all lube oil system piping material, including fittings, after fabrication or assembly, and before installation, by pickling in hot acid.

Thoroughly rinse after the acid bath, acid neutralize, rinse again, dry and immediately coat with a preservative oil.

After installation has been completed, bypass the pumps and piping components that might be damaged or plugged by debris in each individual lube oil system.

Thoroughly clean and flush the piping systems by continuously circulating lube oil at a velocity of at least twenty-five (25) feet per second through a temporary ten (10) micron strainer and filter system, fitted with muslin bags and magnets, until filters remain clean for two (2) consecutive two-hour runs at full flow operation. Flushing shall be accomplished utilizing pumping devices that do not form a part of any piping system permanently installed in the Vessel. See Section 74 of the Technical Specification for additional requirements.

The final flush shall be the same product as the equipment will use.

When a satisfactory level of cleanliness has been attained, remove the flushing oil from the system, paying particular attention to draining low points. Dispose of the used flushing oil and contaminated filters in accordance with current rules, regulations, and laws of cognizant agencies.

Remove all temporary filters and replace all permanent filter elements. Provide a tag on each filter housing which indicates the date the filter was installed and by whom.

Open and manually clean affected sumps, hoses, pumps, valves and tanks with lint-free rags or other suitable wiping material to remove all traces of residual contamination and oil. Final inspection of oil sumps and closure of accesses is to be witnessed by the WSF Representative. Close the sumps and tanks utilizing new gaskets and corrosion resistant nuts and studs/bolts.

**57.9 SPARE PARTS AND INSTRUCTION MANUALS**

Provide a list of recommended spare parts and special tools, for those items which are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

**57.10 TESTS, TRIALS AND INSPECTIONS**

Tests and/or trials shall be provided in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and in Section 1 of the Technical Specification.

**57.11 PHASE II TECHNICAL PROPOSAL REQUIREMENTS**

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Piping System Calculations - Lube Oil Fill, Service and Transfer Systems

B. Piping System Calculations - Used Oil Transfer System

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

**57.12 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS**

The following deliverables, in addition to others required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Piping System Calculations - Lube Oil Fill, Service and Transfer Systems

B. Piping System Calculations - Used Oil Transfer System

C. Lubricating and Hydraulic Oil List

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

**(END OF SECTION)**